

# **ALTERNATIVE ALTERNATING CURRENT POWER SUPPLY AND METHOD OF ITS USE**

## **Background of the Invention**

[0001] The present invention relates to alternating current (AC) electrical power supply and method of its use, and more particularly to a method and apparatus for providing alternating current to an existing electrical distribution system involving the disconnection of the normal source of power to the distribution system, i.e., the electric utility company, and the supply of the alternate source of AC power into an outlet receptacle of the distribution system to power other nodes of the distribution system.

## **Field of the Invention**

## **Description of Related Art**

[0002] U.S. Patent No. 5,949,640 describes the state of the art of typical alternating current inverters. As described by this reference, inverters are generally designed for two installation options. The first installation option is for the inverter to be permanently wired to an AC electrical wiring system in the house, vehicle or building. U.S. Patent No. 6,455,954 shows a hard wired alternative power source connected to the breaker panel. A sensor switch is utilized along with a programmable controller to select the power source provided to the breaker panel.

[0003] The second installation option is a stand alone option. In this approach, standard male plugs from electrical devices are plugged into AC outlet receptacles connected directly to the inverter. Typically, generators and battery powered units have receptacle outlets thereon so that electrically operated devices may be plugged directly into the housing that contains the inverter. A commercial embodiment of this design is sold by Xantrex Company which makes a product under the trademark xPower 1500(™)

of this typical design. U.S. Patent No. 4,376,250 shows a portable power source for providing power through outlets **102**.

[0004] A simple modification of this design is an uninterruptible power supply and voltage conditioner. U.S. Patent No. 4,675,538 shows a traditional uninterruptible power supply where a constant voltage is maintained at outlet terminal **64**. These type devices are well known in the art.

[0005] U.S. Patent No. 5,233,230 shows a specialty power cord capable of providing either utility company AC power or DC power from an internal battery to small appliances. In this design, the plug **12** is utilized to plug into standard wall outlets while the receptacle **14** is utilized to receive the plug from the small appliance. When utility power is out, this device can power resistive loads such as certain electric heaters. It will not work for inductive loads such as electric motors, etc.

[0006] While uninterruptible power supplies, portable generators and hard wired backup power systems are known in the art, there is not believed to be a portable and temporary method of applying power to at least a portion of an existing electrical distribution system which could be easily and quickly operated by the public without a need for electrical expertise.

### **Summary of the Invention**

[0007] Accordingly, it is an object of the invention to provide a convenient temporary power source for providing power to a pre-installed electrical distribution system such as in a residence or other structure or vehicle normally powered by electrical service provided from an electric company. Also, an appliance may be plugged directly into a receptacle on this power source to receive electric power.

[0008] Another object of the present invention is to provide a portable power source for providing temporary power to at least a portion of a permanent distribution system normally powered by a utility company.

[0009] Yet another object of the present invention is to provide a special connector for providing power from another source of AC power to at least a portion of an electrical distribution system normally powered from an electrical AC source, such as an electric company.

[00010] Accordingly, a portable power generation system is comprised of batteries which provide a direct current voltage supply to a DC to AC converter which is then utilized to provide AC power through a special AC conductor into an outlet receptacle of a portion of a power distribution system normally powered by an electric company. Prior to connecting the special conductor to the outlet receptacle, at least one breaker disconnecting the at least a portion of the distribution system is opened so that the portion of the electrical distribution system may be supplied through the use of another power supply. In the preferred embodiment, it is preferred that the main breaker(s) is/are the breaker opened so that the power supply from the electrical company is disconnected from the electrical distribution system.

[00011] Under normal conditions this would result in no power being supplied to any loads of the electrical distribution system, but since power is being provided from the presently preferred source of power into the receptacle, electrical power can be provided through one or more breakers and/or nodes to various electrical loads connected throughout the electrical distribution system.

[00012] The electrical conductor connecting the power source to the outlet receptacle of the power distribution system could be as simple as an electrical cord having two male plugs in some embodiments. In other embodiments, modifications may be made to avoid ground loops. The applicants are unaware of the existence of any such power connector that would operate properly with existing technology. All known devices requiring electrical power have a male plug to plug into an outlet receptacle. All known power sources provide a female outlet receptacle to receive this plug.

**Brief Description of the Drawings**

[00013] The particular features and advantages of the invention as well as other objects will become apparent from the following description taken in connection with the accompanying drawings in which:

Figure 1 is a front plan view of a portable power supply unit according to presently preferred embodiment of the present invention;

Figure 2 is a side view of the portable power unit shown in Figure 1;

Figure 3 is a front view of an inside panel of the portable power unit shown in Figure 1;

Figure 4 is a back view of the inside panel shown in Figure 3;

Figure 5 is a presently preferred embodiment of a connector conduit with 120 volt male plugs for use with the power supply shown in Figures 1 through 4; and

Figure 6 is a schematic diagram representing an electrical distribution system connected to an electrical meter with electric power normally supplied from a utility company while showing how the portable power supply of Figs. 1-4 can be made to

power portions of the electrical distribution system such as with the conduit of Fig. 5 in accordance with a presently preferred method of utilizing the portable power unit.

### **Detailed Description of the Invention**

[00014] Figure 1 shows an alternative power supply 10 held in cabinet 12. A pair of doors 14,16 allow internal access within the cabinet 12 to access batteries 18,20 shown in phantom in Figure 2. Of course, in other designs, the batteries 18,20 could be replaced with a generator or other suitable power storage and/or power producing device.

[00015] From Figure 1, the cabinet 12 is preferably equipped with a drawer 22 to allow for storage. The cabinet 12 is moveable as it is preferably located on rollers shown as casters 24. In the presently preferred embodiment, the alternative power supply 10 is equipped with a set of 120 volt outlet receptacles 26 so that electrical loads can be directly plugged into the alternative power supply 10.

[00016] In an alternative embodiment a high voltage (typically about 240 volt) receptacle 28 may also be utilized. Furthermore, either of the outlets 26,28 may be utilized in conjunction with the connector 30 shown in Figure 5 which will be described in further detail below. The cabinet 12 is preferably equipped with side pulls 32 to assist in maneuvering the cabinet 12 to a desired location, if necessary.

[00017] Figure 3 shows the front side of an interior panel 34. The interior panel 34 has battery locations 36,38,40,42 wherein positive leads 44 and negative leads 46 can connect with positive and negative terminals of batteries 18,20 shown in phantom in Figure 2 when installed. Battery straps 48 are useful in securing the batteries 18,20 to the supports 50,52. The supports 50,52 may also be constructed in the form of a tray to catch battery acid overflow.

[00018] Figure 4 shows a back view of the internal panel 34. The positive and negative leads 44,46 are shown passing through the panel 34. The leads 44,46 are then directed to a junction connector 58,60, or main terminals, along with the charger 54 and an inverter 56. These wires are preferably sized to produce a negligible voltage drop between the batteries 18,20, and the inverter 56 input during maximum power output.

[00019] Connection 62 may be utilized together with a cord and a plug to provide electricity to the charger 54 to charge the batteries 18,20 in one embodiment. The negative leads 46 connect to the negative terminal 58 and to the charger 54. If only 120 volt input AC power is utilized, the negative lead from the connection 62 is connected to the negative terminal 58 as shown. If 120 volt input AC power is utilized, the phase and neutral wires are connected to the charger's AC input. The AC ground wire is connected to the inverter case. The positive output terminal may be connected to 60 as shown. For 240 volt input power, this connection will be slightly different but obvious to one skilled in the art.

[00020] When charging the batteries 18,20 through the cord connected at connection 62, the charger 54 converts AC voltage and current into DC voltage and current to keep the batteries 18,20 properly charged when utility company power is available. It is anticipated that charger 54 will include a processor to determine when the batteries 18,20 have been adequately charged to then prevent further drawing of power from the source of electricity at connection 62. The inverter 56 is utilized to provide power through outlets 26,28 or otherwise, especially through the connector 30 shown in Figure 5. Plugs 64,66 are connected to the inverter so that alternating current may be provided through outlets 26,28,30 shown in Figure 4. Outlet 28 is configured to provide approximately

240 volts while outlets **26,68** are configured to provide approximately 120 volts as shown in Figure 4.

[00021] Connector **30** shown in Figure 5 is very useful in implementing the preferred method of the present invention. While alternative power supply **10** is believed to have some unique functions, its primary objective is to provide electrical power at the outlets **26,28,68**. The connector **30** is comprised of a male plug **70** connected to a cord **72** at a first end which connects to a second male plug **74** at an opposing end of the cord **72**. Although 120 volt male plug **70,74** illustrated, is alternatively possible that male 240 volt plugs of various configurations known in the art could also be utilized, however, that embodiment will be explained in further detail below.

[00022] The first male plug **70** can be plugged in the first or second 120 volt outlets **26** of the alternative power supply **10** as shown in Figure 6. The cord **72** then provides electricity to the second male plug **74**. As shown in Figure 6, this male plug **74** may be connected to a 120 volt outlet of an electrical power distribution such as an outlet in a house, building, or mobile home. By providing power directly into what is normally used as an outlet, that half of the 120 volt system is now powered by the alternating power supply **10**. It is important to disconnect the normal source of electrical power prior to plugging in the alternative power source. Further details describing this method will be described below.

[00023] Figure 6 shows a typical house electrical distribution system **80** with an alternator power supply **10** and method of its use. The electrical distribution system **80** normally receives power from a utility company through a meter **82** which is then normally supplied into an electrical distribution box **84** which contains main breakers

**86,88** coming from the meter **82**. The main breakers **86,88** are normally shut so that power can flow from the utility company, or other normal source **90** to the meter **82** and into the electrical distribution box **84**. Since the utility company or other normal source **90** provides 240 volts into the house, building or vehicle through main breakers **86,88**. Each of the two halves of the box **84** carry 120 volts with respect to ground **92**.

[00024] Inside the box **84** is located ground **96**, neutral **98**, and breakers **100,102,104** and **106**. Of course, more breakers are likely to be present in most distribution boxes **84**. However, for the purpose of illustration, four breakers **100,102,104,106** can adequately show the desired features of the claims. Additionally, although breakers **100** and **104** are illustrated separate and spaced apart, it is also common in the art that the breakers be molded together to then supply a 240 volt outlet with 240 volts.

[00025] Electrical power from the breakers **100,102,104,106** then proceeds to outlets or hard wired loads such as stoves, dishwashers, lights, etc. For purposes of illustration, outlets **108, 109,110, 111** and **112** are shown for illustration purposes. Obviously, most buildings and/or vehicles utilizing electrical distribution system will have significantly more than three outlets **108,109,112** loads such as lights, dishwashers, etc., that are hard wired and/or electrical load type breakers **100,102,104,106**.

[00026] As shown in Figure 6, outlets **108,109,112** are 120 volt outlets due to their configuration within the system **80**, and outlet **110** is a 240 volt outlet. In Europe and other countries, the voltage could differ, similar principles are believed to likely apply.

[00027] The connector **30** is connected to an outlet **26** on the alternative power supply **10** while simultaneously plugged into the outlet **108** or node of the electrical distribution system **80** after the at least one breaker such as main breaker **86** is open. Alternatively, it



is possible that breaker **102** could be open since the outlet **109** would receive power through a portion of the electrical distribution system whether or not the breaker **102** is open or not. If **102** is allowed to remain closed and breaker **86** is opened, then outlet **111** would be powered through breaker **100** as long as breaker **100** remains closed. By opening breaker **86** and maintaining breakers **100** and **102** closed, the load powered from the left half of the distribution box **84** could be powered by the alternative power supply **10**. Of course, no 240 volt loads could be powered since the 240 volt outlet **110** is only receiving 120 volts.

[00028] If an alternative embodiment of the connector **31** as shown in Figure 6 is utilized which is adapted to communicate a 240 volt outlet **28** with 240 volt outlet **110** of the electrical distribution system **80**, then loads connected to both the right and left of the box **84** half may be supplied as long as both main breakers **86,88** are open and breakers **100,102,104,106** remain closed. Outlets **108,109,110** and **112** would all be powered, along with any other selected load by the alternative power supply **10**. Of course, some of breakers **102,106** could be opened to remove undesired loads. Each of the two mains would be powered, but imbalanced loads could cause problems unless a regulated source of power is provided. A somewhat sophisticated generator transformer inverter may be helpful in utilizing this embodiment depending on the loads to be operated.

[00029] While an alternative power supply **10** is shown as battery operated, it should also be readily apparent that generators or other electrical power sources or storage devices could be utilized with the connector **30** to supply portions of the electrical distribution system **80**.

**[00030]** While it is anticipated that four batteries will be utilized in the alternative power supply 10, other numbers of batteries 18,20 may be utilized. For a 1500 watt inverter 56, the battery supply is ideally capable of producing about 125 amps of electrical current. Since one embodiment of a battery can typically supply 25 amps for two hundred twenty minutes, it appears that four batteries connected parallel would be necessary so that the current required from any one particular battery would be around 30 amps. It has been found that loading a battery past that point significantly reduces the supplied amp hours from the battery.

**[00031]** The leads 44,46 connecting the batteries 18,20 to the inverter 56 were determined to be have a preferred wire size of number 6AWG so they can handle 33 amps DC load. The wires connecting the main terminals 58,60 to the input of the inverter 56 and of the charger 54 are preferred to be number 4AWG and of similar lengths. At the output of the inverter 56, cables which use 12-2 round cable with standard 120 volt plugs 64,66 are preferred. Standard 120 volt 20 amp receptacles were utilized as outlets 26,68. The charger 54 of the preferred embodiment is a 1.5-amp trickle charge battery charger so that noxious fumes were not formed during charging. With the preferred configuration a 1500 watt continuous and 3000 watt momentary capacity inverter 56, the alternative power supply 10 is a relatively powerful electrical force.

**[00032]** An electrical utility outage of approximately two or three days could be sustained using charged batteries having a reserve capacity (RC) of at least 220 minutes. Of course, high powered appliances such as microwaves, refrigerators, and freezers, would only be utilized when needed and only for short periods. Other low power appliances such as TV, lights, computers, radios, etc., could be left on as needed during a

power outage. If power outages are suspected as always being short, such as 15 minutes to one hour, a single battery **18** could power the alternative power supply **10** properly.

[00033] In conducting tests with the prototype unit, a Cobra electronics HGPI 2000 inverter **56** works satisfactorily. Other cheap inverters were found to burn out at medium powers and low powers. They also were prone to failing to protect users from electric shock.

[00034] During testing, it was found that it was more convenient to connect the power supply **10** to the building electrical system **80** so that it could power some or all of the pre-existing system **80**, and thus, some or all of the appliances and loads already connected to it at the central breaker box **84**. An analysis of this possibility showed that for voltages of approximately 120 volts, the connector cord **30** could be used if the cord's ground wire was cut to prevent ground loops from occurring which would otherwise cause noise and/or rob energy from the system **80** and/or supply **10**. If the ground wire is not cut, there can be two points, separated by a relatively long length of wire, between which the electrical circuit will be grounded (see Figure 6). This could result in ground loops.

[00035] Cutting the ground wire, or alternatively, not providing such a wire with the cord **30** on the connector cord **30**, is useful to avoid the possibility of problematic ground loops. The step of cutting an existing ground wire for this purpose is believed to be new.

[00036] Powering both halves of the box **80** is contemplated with a 240 volt connector with 240 volt male plugs on either end, it is alternatively possible to use two 120 volt connectors as illustrated in Figure 5 so long as outlets are utilized on opposite halves of distribution box **84** such as one of **108,109, 111** with one connector **30** and another

connector 30 connected to outlet 112 as shown in phantom in Figure 6. This would then power everything in box 84 including 240 volt outlet 112. Load imbalance problems have been discussed above as they relate to the use of alternative embodiment connectors. Since powering two “phase” nodes 86,88 may draw differing amounts of power from the alternative power source 10, the source 10 must be able to operate in this manner. A regulator may need to be connected in the mode of operation. Furthermore, there is not believed to be a need to cut ground wires to avoid ground loops in this configuration.

[00037] Of course the cord 30 could contain a 120 volt plug on the end which connects to the supply 10 and a 240 volt plug on the end which connects to the electrical distribution system 80. Since only 120 volts would be supplied, although perhaps only portions of 240 volt appliances would operate, the 120 volt electrical distribution system 80 would still be supplied with 120 volts since the 120 volts would be supplied to both halves of the 240 volt plug, only not out of phase as they are normally provided.

[00038] Figure 6 also shows another cord 31 in phantom which has a 240 volt plug on each end. Figure 7 shows a detailed view of this cord embodiment. There are a variety of 240 volt plug configurations which are known in the art such as those utilized with stoves, dryers, air conditioners, etc. The illustrated embodiment is just one variation.

[00039] Figure 8 shows an adapter 33 that may be utilized with the embodiment of Figure 5 to create the embodiment shown in Figure 9. The adapter 33 includes a male 240 volt plug 35 and a female 120 volt plug 37. Of course, other 240 volt plug configurations are known in the art. With one of the two male plugs shown in Figure 5 plugged into female plug 37, the functional equivalent of cord 39 of Figure 9 is created which has a 240 volt plug 41 and a 120 volt plug 43 and may be utilized as described

above for such a configuration. Of course other 240 volt plug configurations may be substituted for the illustrated configuration.

**[00040]** Numerous alterations of the structure herein disclosed will suggest themselves to those skilled in the art. However, it is to be understood that the present disclosure relates to the preferred embodiment of the invention which is for purposes of illustration only and not to be construed as a limitation of the invention. All such modifications which do not depart from the spirit of the invention are intended to be included within the scope of the appended claims.

**[00041]** Having thus set forth the nature of the invention, what is claimed herein is: